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# An Intuitive Eating Intervention for Healthy Living Among University Employees

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## Abstract

Programs that target weight management typically employ restrictive eating strategies to achieve weight loss. Although short-term weight loss is often attained, these traditional diet programs have been associated with weight gain and higher psychological distress (e.g., Linardon & Mitchell, 2017). Increasingly, employers are offering worksite wellness programs to optimize employee productivity and decrease costs associated with health care coverage (Goetzel & Ozminkowski, 2008); however, data demonstrate that the typical diet interventions provided in the workplace have been insufficient (Osilla et al., 2012). An alternative approach to such dieting interventions is to emphasize intuitive eating (IE) over restrictive eating. IE is an approach to eating regulation that emphasizes eating in accordance with physiological hunger and satiety cues. Eating intuitively has been found to be associated with more positive body image, less disordered eating, lower body mass index (BMI), and lower psychological distress (Bruce & Ricciardelli, 2016; Tylka et al., 2015). However, many IE intervention studies lacked quality randomized controlled trials, had limited outcome measures, and did not include a long-term follow-up (e.g., Benedict & Arterburn, 2008; Bush et al., 2014; Tam & Yeung, 2018), The current study improved upon limitations in previous studies and assessed the effects of an 8 week intuitive eating intervention on university employees who were randomly assigned to an intuitive eating ($n$ = 22) versus a waitlist control group ($n$ = 20). We examined changes in intuitive eating, appetite awareness, self-efficacy related controlling eating and weight, body satisfaction, BMI, life satisfaction, and work absenteeism both across intervention conditions and over time (baseline vs. post intervention) using multilevel modeling. The IE intervention appeared modestly effective in increasing participants' awareness and knowledge of eating intuitively. However, across other variables, the IE group showed small, but non-statistically significant

improvements in comparison to the control group. Use of IE with larger samples could better clarify the impact of an IE intervention. It may also be that an IE intervention alone may not be effective without additional components such as mindfulness or strategies targeting self-efficacy to change. Additional research focused on establishing a better understanding of factors that facilitate increases in intuitive eating habits and associated changes could be helpful.

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# Literature Review

Obesity is a widespread epidemic in the United States that poses significant public health concerns (Berenson, 2012; U.S. Department of Health, 2017). Obesity is associated with a host of physical health problems such as heart disease, respiratory disorders, cancer, osteoarthritis, high blood pressure, and type 2 diabetes among other conditions (Expert Panel Report, 2014). There is also the associated burden of increased health care costs, as the annual medical expenditures of obese individuals in the U.S. is $3,429 more than for individuals of healthy weight (Biener et al., 2017). Moreover, direct and indirect obesity-related costs to employees and employers are substantial. For instance, compared to individuals within a healthy weight range, obese workers file twice the number of workers' compensation claims, take more sick days, and experience greater health-related work limitations that affect productivity (Cash et al., 2012; Gates et al., 2008).

The effects of obesity are also associated with negative psychological consequences and are predictive of poor psychosocial functioning and well-being. Depression and anxiety are more common in individuals who are obese compared to people within healthy weight ranges (Simon et al., 2006; 2008). Furthermore, poor body image, lowered self-esteem, and deficits in interpersonal effectiveness are associated with obesity (Preiss et al., 2013; Simon et al., 2006). It has also been documented that obesity is correlated with higher rates of binge eating and emotional eating (Preiss et al., 2013; Puhl & Suh, 2015). Thus, not only does obesity have a significant impact on physical health and financial domains, but it is also associated with poorer psychological well-being for some individuals.

**Theories Relating Eating Behaviors to Obesity**

Although multiple factors contribute to obesity, adequate management of food intake is essential (Hwalla & Jaafar, 2020). It is well documented that eating behavior is highly cue-dependent (e.g., Prinsen et al., 2013; Wansink et al., 2010), with two main categories of food cues, internal and external. Internal food cues are the body's physiological mechanisms of appetite often called hunger and satiety cues. External food cues include seeing or smelling food, stress, observing others eat, and advertisements. Emotions and stress are generally regarded as external (non-physiological) as they are often influenced by environmental and experiential factors. It has been suggested that external cues can override eating in response to internal cues, and thus facilitate unhealthy eating behaviors (Bilman et al., 2017; Cohen, 2008). Researchers have developed and tested multiple theories that explain the dynamics of food cues involved in eating behavior and weight management. These theories include the theory of externality, the psychosomatic theory, and the theory of dietary restraint.

Schachter's (1968) theory of externality in obesity suggests that obese individuals are more influenced by non-physiological (external) desires to eat and less able to recognize the physiological cues of hunger and satiety than normal weight individuals. For instance, those who overeat are more likely to be impacted by the hedonic properties of food (e.g., palatability, fat content, sugar content; Blundell & Finlayson, 2004; Burton et al., 2007) and attribute their food intake to external cues (Vartanian et al., 2017). Therefore, individuals' susceptibility in weight gain may be partly due to heightened responsiveness to external food cues.

Similar to the externality theory, the psychosomatic theory of obesity posits that obese individuals are less responsive to internal physiological cues of hunger and satiety (Kaplan & Kaplan, 1957). In contrast to the theory of externality, the psychosomatic theory focuses on

eating in response to emotional arousal. Many individuals who have a difficult time regulating their mood, particularly when they are sad, distressed, or lonely, seek comfort in food and may engage in overeating and binge eating. Research indicates that increased stress can decrease emotional and behavioral control and impair the capacity to inhibit eating (Sinha, 2008). This deficit in emotional regulation is associated with binge eating behaviors and weight gain (Hays & Roberts, 2008; Leehr et al., 2015). The guilt and distress that often follows binge eating episodes leads to further negative emotions and perpetuates the continuous pattern of using food as an emotional coping mechanism (Leehr et al., 2015). Studies indicate that the repeated pairing of emotional distress and eating contributes to the reduced sensitivity to internal hunger and satiety cues (Tauber et al., 2011). With increased frequency of emotional eating, it is logical to expect weight gain leading to the development of obesity.

According to the theory of dietary restraint (Herman & Mack, 1975; Polivy & Herman, 2017) overeating often occurs as a consequence of restrictive dieting. This theory is based on the assumption that the body has a set point with weight, which it can regulate homeostatically. Attempting to lose weight by limiting food intake can initiate physiological defenses such as lowering the metabolic rate, increasing arousal of persistent hunger (Strien & Ouwens, 2003), and displacing the satiety boundary upwards (Stroebe et al., 2008). The chronic self-control to abide by these restricted eating behaviors requires an increased amount of cognitive resolve that is ultimately unsustainable (Polivy & Herman, 2017). Thus, when cognitive control is depleted or undermined by disinhibitors (e.g., alcohol, stress), counter-regulation (eating large amounts of food) may occur, thereby inducing periods of unhealthy eating patterns like binge eating. Furthermore, dietary restraint fosters an increased preoccupation with food, eating, and weight control (Polivy & Herman, 2017). This preoccupation contributes to the propensity to engage in

dichotomous thinking by categorizing foods as “good” (diet) or “bad” (diet-breaking), which in turn, is shown to further contribute to the reduction of sensitivity to internal hunger and satiety cues (Johnson et al., 2012). This then increases the likelihood of overeating post-diet, leading to eventual weight regain (Schembre, 2011).

These theories all explain how a number of factors can interfere with one’s ability to recognize hunger and satiation as well as the ability to differentiate hunger from other signals of discomfort. Research further supports these theories by showing that a decrease in responding to external cues is associated with weight loss and lower weight (Ciampolini et al., 2010; Dalen et al., 2010; Herbert et al., 2013; Madden et al., 2012), whereas eating in response to the body’s physiological hunger and satiety cues (“innate eating”) is positively related to psychological well-being, self-esteem, and positive affect (Bacon et al., 2005; Tylka et al., 2015; Tylka & Kroon Van Diest, 2013). The linkage of innate eating to positive psychological outcomes and decreased risk of weight gain further emphasizes the importance of targeting innate eating cues for effective eating interventions with overweight individuals.

**Traditional Dieting**

Dieting as an approach to weight loss has been a widely used tactic to counteract the negative effects of overweight and obesity. Indeed, even public health policy recommends energy-restriction diets for overweight individuals (Expert Panel Report, 2014). Surveys estimate that among obese individuals trying to lose weight, 76% met calorie restriction recommendations (Weiss et al., 2006). Despite the increase in dieting behavior, the incidence of obesity has continued to rise over the past few decades (National Center for Health Statistics, 2018).

The paradigm of traditional dieting programs assumes weight loss must happen to improve health and quality of life. Popular weight-loss programs often have a strict eating

schedule that promote restricted eating patterns involving reduced calorie intake and decreased consumption of fat, carbohydrates, and/or sugar. In line with the theory of dietary restraint, such rigid dietary control often takes a dichotomous approach to eating in which food is conceptualized as all "good" or "bad" (Linardon & Mitchell, 2017). Although these methods generate short-term results, a growing body of research indicate they are less effective long-term as individuals are unable to maintain the dietary habits and health improvements (Atallah et al., 2014; Mann et al., 2007; Polivy & Herman, 2017).

Longitudinal research indicates that many people gain more weight than when they initiated a dietary weight-loss program; especially when they participate in programs that emphasize rigid dietary restraint (Mann et al., 2007; Neumark-Sztainer et al., 2007; Saarni et al., 2006). In fact, research indicates that weight-centered dietary programs can contribute to food and body preoccupation, lower self-esteem, and disordered eating such as binge eating (e.g., Bacon et al., 2005; Linardon & Mitchell, 2017).

Similar results have been found in most diet programs implemented in the workplace. Systematic reviews examining the effectiveness of worksite-based dietary interventions found support for worksite interventions to reduce weight in the short-term, but the majority of the studies were methodologically weak (e.g., inadequate randomization, not accounting for high rates of attrition) and did not assess additional outcome measures other than body mass index (BMI; Benedict & Arterburn, 2008; Tam & Yeung, 2018). One review in particular (Tam & Yeung, 2018) examined the effects for long-term (greater than 1 year) weight loss and maintenance. The researchers found that only five of the 11 studies reported significant BMI changes in the intervention group over the one to two years, and only three of these studies were

of relatively good quality (Tam & Yeung, 2018). Given the lack of quality work-based lifestyle interventions assessing BMI as well as other outcomes, further research in this area is warranted.

**Intuitive Eating (IE)**

In contrast to traditional dieting interventions, non-diet based approaches focus on helping individuals abandon restrictive eating patterns and advocate for eating intuitively (Avalos & Tylka, 2006; Bacon et al., 2002; Kausman et al., 2003), an eating style that promotes sustainable health behaviors (e.g., eating breakfast, regular meal patterns) to improve psychological and physical well-being. Aligned with the theoretical basis of over-eating such as the psychosomatic and dietary restraint theory, IE is characterized by eating in response to internal physiological hunger and satiety cues rather than external factors such as situational and emotional cues (Tylka, 2006). People differ in the extent to which they eat in an intuitive manner. Cross-sectional research indicates that those who eat more intuitively are more likely to have lower rigid dietary control, body image concerns, eating disorder symptomology (Tylka et al., 2015; Tylka & Kroon Van Diest, 2013), and greater well-being and psychological health (Brown et al., 2010; Denny et al., 2013; Dyke & Drinkwater, 2013; Linardon & Mitchell, 2017; Tylka et al., 2015; Warren et al., 2017).

To assess the level of IE among individuals, Tylka (2006) developed and revised the Intuitive Eating Scale (IES-2) that operationalized the concept of IE as having four central features: (a) unconditional permission to eat when hungry and the food that is desired; (b) eating for physical rather than emotional reasons; (c) reliance on internal hunger and satiety cues to determine when and how much to eat; and (d) body-food choice congruence.

### *Unconditional Permission to Eat*

Unconditional permission to eat reflects the readiness to eat in response to internal physiological hunger cues and the food that is desired at that moment (Tribole & Resch, 1995; 2003; 2012). Individuals who embrace this strategy are not preoccupied with dietary rules and labeling food as good or bad. Giving oneself unconditional permission to eat is inversely related to eating disorder symptomology (Tylka & Wilcox, 2006) and behaviors that are often associated with weight gain (Hawks et al., 2005; Tylka, 2006). Conversely, those who place conditions on food intake and restrain their eating tend to have an increased preoccupation with food and are more likely to overindulge in food due to perceiving that they violated a dietary rule (Polivy & Herman, 1999).

### *Eating for Physical Rather than Emotional Reasons*

Individuals who eat more intuitively primarily use food to satisfy physical hunger, rather than emotional needs (Tribole & Resch, 1995; 2003; 2012). Conversely, when people eat in response to emotional cues they are less aware of innate hunger and fullness. As a result, individuals may have difficulty differentiating between hunger cues and emotional arousal, thereby possibly developing a disordered relationship with eating (Dyke & Drinkwater, 2013). The tendency to eat for physical rather than emotional reasons is correlated with psychological well-being, positive affect, less food preoccupation, less binge eating (Tylka & Wilcox, 2006), and lower body weight (Herbert et al., 2013).

### *Reliance on Internal Hunger and Satiety Cues*

A fundamental premise of IE is the importance of accurately attending and responding to internal physiological cues to guide eating behaviors. Individuals who do not follow their internal hunger cues are more likely to engage in dietary restraint, disordered eating patterns, and

weight gain (Johnson et al., 2012). Eating in response to hunger and satiety cues is associated with interoceptive sensitivity (Herbert et al., 2013) and lower body weight (Denny et al., 2013; Herbert et al., 2013; Madden et al., 2012).

### *Body-Food Choice Congruence*

Body-food choice congruence reflects the tendency for individuals to make food choices that honor their health and body functioning (Tylka & Kroon Van Diest, 2013), also referred to as gentle nutrition (Tribole & Resch, 2012). Eating in this way involves choosing foods that not only taste good but are nutritious and help the body perform efficiently (e.g., increase energy and stamina). Body-food choice congruence has been found to be related to increased psychological well-being and body appreciation (Tylka & Kroon Van Diest, 2013). Furthermore, body-food choice predicts unique variance in life satisfaction and positive affect compared to the other IE principles (Tylka & Kroon Van Diest, 2013).

## Intuitive Eating Interventions

Training in IE is a component of many non-diet based interventions, often with adjunctive mindfulness or cognitive-behavioral approaches. Mindfulness is portrayed as having an open awareness to the present moment in a nonjudgmental way, with mindfulness training typically incorporating the practice of meditation. Meditation practices are done in an effort to increase one's propensity to be mindful during everyday activities. Mindful eating training tends to combine features of both general mindfulness, application of these principles to eating, as well as other IE principles. Both mindful eating and IE promote positive eating attitudes, increased awareness of the body's relationship with food, and training on mindful awareness of sensations of eating (e.g., taste, texture). Conversely, IE places a greater emphasis on the importance of reestablishing the connection with the body's natural physiological hunger and satiety cues while

also addressing issues of cognitive distortions and emotional eating. The approach does not, however, teach general meditation practices (Tribole & Resch, 1995, 2003, 2012). Eating intuitively has consistently been linked to having a lower and healthier body weight, whereas this relationship is not often found with mindful eating (e.g., Anderson et al., 2015; Denny et al., 2013; Herbert et al., 2013).

Due to the overlap between mindful eating and IE, as well as being used in adjunct to other strategies, it has been difficult to ascertain the effect IE training has independent of other strategies, as well as the degree to which IE interventions may affect one's ability to be mindful without exposure to general meditation practice. Two manualized interventions in which IE is the main focus include *Health at Every Size* (e.g., Bacon et al., 2002) and Tribole and Resch's (1995, 2003, 2012) *Intuitive Eating*.

### *Health at Every Size*

Health at Every Size (HAES) is an example of a lifestyle intervention characterized by the non-diet philosophy that promotes a holistic approach toward psychological and physical wellness at any weight. HAES employs IE principles that foster conscientious eating in response to physiological hunger and fullness cues instead of emotions or external cues. HAES, like many non-diet programs, addresses themes such as respecting body shape, enjoying physical activity, nutrition education, and social support. Randomized controlled studies have demonstrated the effectiveness of HAES in improving psychological outcomes compared to a diet-based program (Bacon et al., 2002; Bacon et al., 2005), social support groups, and wait-list control groups (Carroll et al., 2007; Gagnon-Girouard et al., 2010; Leblanc et al., 2012; Provencher et al., 2007, 2009). Other studies have also shown the long-term effectiveness of HAES with improvements in several psychological measures (e.g., depression, distress, self-esteem, quality of life, and

binge eating) at 16-month follow-up as compared to a wait-list control and social support comparison group (Gagnon-Glouard et al., 2010; Provencher et al., 2007, 2009). Although the HAES intervention encompasses many IE principles, it does not as thoroughly focus on rejecting the diet mentality and listening to the body's innate eating cues, as is the case with Tribole and Resch's approach.

### *Tribole and Resch's IE Intervention*

Tribole and Resch published their self-help guide, *Intuitive Eating*, in 1995. Since that time, they revised their intervention (Tribole & Resch, 1995. 2003, 2012) and it has been adapted for use in group-based IE interventions. In their book, Tribole and Resch describe 10 core IE principles that serve as the session topics for the intervention: (a) reject diet mentality, (b) honor your hunger, (c) make peace with food, (d) challenge the food police, (e) feel your failure, (f) discover the satisfaction factor, (g) cope with your emotions without using food, (h) respect your body, (i) exercise - feel the difference, and (j) honor your health - gentle nutrition.

Four published intervention studies have evaluated the effectiveness of Tribole and Resch's IE program (Anglin, 2012; Bush et al., 2014; Cole & Horacek, 2010; Healy et al., 2015). Although outcomes generally supported the use of this intervention, several limitations including high attrition rates, small sample size, and inconsistency in variables assessed, suggest that further research is warranted in order to obtain a better picture of the effectiveness of IE as an approach to improving health and wellbeing.

Cole and Horacek (2010) randomized 61 adult females to a group IE intervention or no treatment control group. Participants were assessed at baseline, post-intervention, and a 6-month follow-up. Although there was considerable attrition (over 50%), this intervention appeared effective in helping participants who completed the intervention to recognize and refrain from

eating due to external cues (i.e., emotional eating). At the end of the program, participants' desire for weight loss as a means to achieving happiness was reduced as well as their food-guilt association. Compared to the control group, those in the IE group reported a decrease in diet mentality and increase in IE from pre- to post-test (large effect) and pre-test to follow-up (medium effect). However, there was no significant difference between the intervention and control group on BMI or healthy food intake, and validated measures were not used to assess outcomes.

Anglin (2012) conducted a randomized controlled pilot study comparing a calorie restriction approach to an intervention based on Tribole and Resch's (2012) IE principles. Participants ($N$ = 16) included sedentary obese individuals. The duration of the study spanned 6 weeks and measurements taken at baseline, midpoint, and endpoint. This study only analyzed body composition as an outcome, which showed the calorie restriction group as superior for short-term weight loss. Limitations of this study include small sample size, lack of psychological measures, and no follow-up assessments beyond the conclusion of the group sessions.

More recently, Healy and colleagues (2015) conducted a quasi-experimental study, adapting Tribole and Resch's (2012) IE protocol to a high school health course. The intervention group ($n$ = 22) was taught the IE principles through presentations over the course of 7 days. The comparison group ($n$ = 26) was taught nutritional and body image information. Students who were taught the principles of IE made significantly greater gains in positive eating attitudes ($\eta^2$ = .09) as measured by participants' total IES-2 score. Specifically, participants in the IE program demonstrated significant shifts in attitudes from rigid dietary control toward greater acceptance of foods as measure by the IES-2 subscale Unconditional Permission to Eat ($\eta^2$ = .12). However, there were no significant changes in the other IES-2 subscales.

To date, only one study (i.e., Bush et al., 2014) utilizing Tribole and Resch's IE intervention in a worksite setting was identified. In this study, university female employees ($N$ = 76) who wanted to address problematic eating behaviors were recruited to participate in a 10-week workplace wellness program referred to as *Eat for Life*. There were no weight criteria for inclusion in the program, though most employees were obese. Weekly, hour-long sessions focused on themes comparable to the Tribole and Resch's (2012) 10 principles of IE with each session including a topic of focus (e.g., internal vs. external cues) and mindful eating exercises. Separately, a group of 93 female employees were recruited to complete two sets of surveys that were 10 weeks apart, thus serving as a comparison group. Of completers, notable differences between the intervention and comparison group were observed for all outcomes at the end of the intervention, including improved body appreciation ($\eta^2$ = .25), IE ($\eta^2$ = .36), and mindfulness ($\eta^2$ = .20). Moreover, individuals in the intervention group were 3.7 times more likely to be asymptomatic from problematic eating patterns than those in the comparison group (Bush et al., 2014). Although this study suggests IE may have positive effects on body image and eating attitudes and behaviors, major limitations of this study are evident, including selection bias due to the use of a nonrandomized design (the treatment group chose to participate in an intervention whereas the comparison group did not), high attrition rate (> 30%), and lack of a long-term follow-up. Thus, caution is warranted when interpreting the results as such large effects might reflect the higher motivation to change of those who chose to complete the intervention.

Despite limitations, the recent findings by Bush and colleagues (2014) offer some optimism for effectively intervening within the worksite setting. Importantly, the workplace may be an optimal place to implement these interventions due to the ease of population access as well as the possibility of reducing healthcare-related costs and improving health and work-related

outcomes. Research suggests some promise for worksite-based weight-loss interventions, but this remains an understudied area, especially with examining the effects of IE rather than traditional weight loss principles or IE in conjunction with other intervention approaches. Furthermore, few outcomes have been assessed and there is a lack of quality randomized controlled trials that include follow-up assessments investigating weight maintenance (Benedict & Arterburn, 2008; Tam & Yeung, 2018). The limitation of having mainly post-intervention evaluations to inform program design and effectiveness is that it leaves the issue of the maintenance of weight loss unanswered.

## Specific Aims and Hypotheses

The present study, a worksite IE intervention, was conducted to contribute to the limited body of research examining IE interventions. It also addressed limitations of previous investigations noted above. That is, we have improved upon the methodology of previous studies by using a randomized control design and included a follow-up assessment. It is anticipated that IE, delivered in a worksite group format, will foster the development of sustainable skills that employees can utilize to regulate their eating behavior and increase their psychological and physical health.

We hypothesized that in comparison to a wait list control group, the IE intervention group would exhibit greater increases in (a) IE and awareness of appetite signals, (b) self-efficacy related controlling eating and weight, (c) body satisfaction, (d) life satisfaction, and (e) physical activity, as well as greater decreases in (f) BMI and (g) work absenteeism at post-intervention and 6-month follow-up. We also explored the effect of the intervention on perceived stress, general mindfulness, and physical activity as the IE intervention does not directly target these skills, but there is preliminary evidence that the IE intervention may affect these behaviors.

# Method

## Participant Recruitment and Procedures

All university employees at a midsized Midwestern university, both full-time and part-time, received a recruitment email sent by the employee wellness program announcing the spring 2017 IE group. Interested employees contacted the group facilitator, a registered dietician, to sign up. Random assignment, using a random number generator, was used to assign participants to either the IE intervention ($n$ = 25) or WL condition ($n$ = 25; see Figure 1).

The dietician emailed each person informing them of their group assignment. Within the email, employees were informed of the research study opportunity and notified that they would be contacted by the researcher with an invitation to participate. The primary investigator sent this email within 48 hours to both groups. A reminder email was sent 5 days later to those who did not respond to the initial email, followed by a phone call a few days later. There was limited space in the IE intervention. Participants in the control group were informed of this and notified that they would be placed on a waiting list for the next IE intervention offering in the fall. They were not asked to refrain from participation in any other wellness activities or weight loss interventions. Unlike a typical randomized clinical trial design, potential participants in this study were informed of the research opportunity after random assignment.

Embedded within the email invitation was a link to an online questionnaire administered via Qualtrics. At the start of the survey, participants were asked to read the consent form and confirm their consent to participate in the study. Those who expressed not wanting to take part in the research study were not contacted again regarding the study; their participation in the IE program was not affected. A total of eight employees chose not to participate in the research evaluation of the intervention, three of whom had been initially assigned to the IE group and five

to the WL group. It should be noted that at least two of these people in the WL group may have refused research participation due to familiarity with the researchers. Thus, the starting sample included 22 IE participants and 20 WL participants. Within 48 hours of the final IE group session, all study participants were emailed a link to the Time 2 survey and were sent up to two reminder emails. Similar procedures were followed at Time 3. All participants were compensated with a $25 Amazon gift card for their survey completion following the post-intervention (Time 2) survey. An additional $20 Amazon gift card was offered for those who completed the 6-month (Time 3) follow up.

**Study Design**

Participants were randomly assigned to either the IE group or the waitlist control group (WL). This study used a 2 x 3 mixed factorial experimental design, with treatment condition (intervention vs. control) as the between subjects factor and time (pretest, posttest, and 6 month follow-up) as the within subjects factor, to evaluate an IE group intervention for university employees. Participants in both conditions completed self-report questionnaires examining a number of variables related to health, eating, and other psychosocial factors. Both groups received the questionnaires at three time points, prior to the start of the intervention (Time 1), at the conclusion of the intervention (Time 2), and a 6-month follow-up (Time 3) in order to assess maintenance of changes in these outcomes. The intervention component took place during a spring semester (February to April, 2017).

**Intervention**

The IE intervention was led by a registered dietician employed by the university. The intervention was adapted from Tribole and Resch's (2012) book *Intuitive Eating*. The intervention was delivered in eight weekly 1-hour sessions, the original 10 IE principles

condensed to weekly themes. Each session focused on a different theme, including: (a) food beliefs, (b) hunger and satiety cues, (c) make peace with food, (d) body appreciation, (e) appreciating you, (f) feeding your true hunger, (g) movement for fun, and (h) gentle nutrition. The basic components of the intervention can be found in Appendix A. Participants were given a handout each week with guidelines to help them follow each principle. The dietician facilitated group discussion, with participation and questions encouraged throughout each session. A typical session included a review of the previous week's homework, small group and large group discussions, individual reflection time, and a group exercise (e.g., practicing use of a hunger scale).

## Measures

The online survey consisted of several validated measures designed to assess a variety of outcomes. Additionally, participants answered demographic questions (gender, age, ethnicity, level of education, position at UMD) and reported their medical and health history. All measures were included across all survey time points except for weight history, medical and health history, and demographic questions, which were asked only at baseline (Time 1). The post-intervention (Time 2) survey included additional questions assessing knowledge of IE concepts as a manipulation check. The baseline survey and additional knowledge questions can be found in Appendix B.

### *Primary Outcome Measures*

**Intuitive Eating.** The Intuitive Eating Scale – 2 (IES-2; Tylka & Kroon Van Diest, 2013), includes 23 items designed to assess current levels of intuitiveness and impulsivity related to eating behaviors. The IES-2 is comprised of four subscales: (a) Unconditional Permission to Eat (e.g., "I have forbidden foods that I don't allow myself to eat"), (b) Eating for Physical

Rather than Emotional Reasons (e.g., “I use food to help me soothe my negative emotions”), (c) Reliance on Hunger and Satiety Cues (e.g., “I trust my body to tell me when to eat”), and (d) Body-Food Choice Congruence (e.g., “I mostly eat foods that give my body energy and stamina”). Items are rated on a 5-point Likert-type scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores are associated with greater endorsement of IE. Confirmatory factor analysis supported the four-factor structure, CFI = .96. In the current study, the internal consistency for the IES-2 total score ranged from $\alpha$ = .78 to .85 across the three time points.

**Appetite Awareness.** Awareness and use of satiety and hunger cues were assessed using items from the Interoceptive Awareness Questionnaire-Expanded (IAQ-E; Trenary et al., 2005), which is an expansion of the Interoceptive Awareness subscale included on the Eating Disorders Inventory-2 (Garner, 1991). The IAQ-E is a 15-item self-report measure. In the present study, only the 11 items of the appetite subscale were used to assess individuals’ ability to detect and follow the body’s natural hunger cues and eat at moderate levels of hunger, all of which align with IE principles. The IAQ-E uses a Likert-type scale with ratings from 1 (*never*) to 6 (*always*). Higher scores indicate poorer appetite awareness. Sample items include “I continue to eat after I feel full” and “I don’t notice I’m hungry until I’m ravenous.” The IAQ-E appetite items focus more narrowly on an individual’s levels of awareness regarding physiological sensations of appetite, whereas the IES-2 includes items that assess a broader range of experiences that interfere with an individual’s awareness of their physiological sensations of hunger. In the current study, the IAQ-E item’s internal consistency ranged from $\alpha$ = .85 to .88 across the three time points.

**Eating-Related Self-Efficacy.** The current study also assessed participants’ self-efficacy at regulating their eating behaviors. The Weight Efficacy Lifestyle Questionnaire (WELQ; Clark

et al., 1991) was originally designed for use in weight-loss programs to measure how confident respondents are about their ability to resist eating in response to situational factors that can make food resistance challenging. The WELQ includes 20 items grouped into five subscales consisting of four items each. Subscales represent different situations including when food is highly available (e.g., "I can resist eating even when high-calorie foods are available"), feeling negative emotions (e.g., "I can resist eating when I am depressed"), experiencing physical discomfort (e.g., "I can resist eating when I feel uncomfortable"), engaging in positive activities (e.g., "I can resist eating even when I am at a party"), and experiencing social pressures to eat (e.g., "I can resist eating even when I have to say 'no' to others"). Each item is rated on a Likert-type scale from 1 (*not confident*) to 10 (*very confident*) with higher scores reflecting greater subjective self-efficacy, indicating the degree of adaptable self-control over eating behaviors. In this study, the overall mean score was calculated. In the current study, the WELQ total score internal consistency ranged from $\alpha$ = .93 to .95 across the three time points.

**Weight Management Perceived Competence.** Two items were used from the Perceived Competence Scale (PCS; Williams et al., 1999) for maintaining a healthy diet. This scale assesses the degree to which participants feel confident about being able to make or maintain a change. The items included were "I feel confident in my ability to manage my weight" and "I am able to manage my weight permanently." Each item was rated on a 7 point Likert – type scale from 1 (*not at all true*) to 7 (*very true*). Internal consistency for this measure was $\alpha$ = .77 to .96.

**Body Satisfaction.** An adapted version of the Body Parts Satisfaction Scale (BPSS; Berscheid et al., 1973) was used to assess participants' level of satisfaction with various body parts. This study used a modified version which included eight (i.e., weight, figure/build, stomach, waist, thighs, buttocks, hips, and legs) of the original 25 items. We excluded items that

were less relevant for the purpose of this study (e.g., lips, ears). Responders rated each body part on a 5-point scale from 1 (*extremely dissatisfied*) to 5 (*extremely satisfied*). In the current study, internal consistency for this scale ranged from $\alpha = .94$ to .95.

**Life Satisfaction.** The Personal Wellbeing Index – Adult (PWI-A; International Wellbeing Group, 2013) is a single item measure of quality of life and life satisfaction. The item is stated as: "Thinking about your own life and personal circumstances, how satisfied are you with your life as a whole?" and rated on a Likert-type scale from 1 (*not at all satisfied*) to 10 (*extremely satisfied*). It has been found to correlate ($r = .78$) with Diener and colleagues' (1985) Satisfaction with Life Scale (International Wellbeing Group, 2013).

**Body Mass Index.** Clinical guidelines for classifying overweight and obesity are based on body mass index (BMI), calculated in metric by dividing weight by height squared. Based on the World Health Organization (WHO) BMI cutoffs, overweight status is defined by a BMI of 25 to 29.9 and obesity is a BMI $\geq 30$. We used self-reported height and weight to calculate each participant's BMI. The reliance on self-reported BMI/weight is not ideal, though previous work has shown that objective weight measurements and self-report are highly correlated ($r = .98$; Lloyd-Richardson et al., 2009).

**Absenteeism.** Absenteeism from work is associated with obesity (Cawley et al., 2007); therefore, we included an item that asks how many hours the participant missed from work in the past 4 weeks due to a health problem.

### *Exploratory Outcome Measures*

**Mindfulness.** The Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) measure assesses different aspects of mindfulness. A 24-item short form, FFMQ-SF (Bohlmeijer et al., 2011), has been found to be reliable and valid, and is highly correlated with the original,

longer version (range of $r$ = .77 to .98) with content validity and psychometric properties sufficiently preserved. The measure also demonstrates adequate test-retest reliability ($r$ = .85; Bush et al., 2014). The items are rated on a Likert-type scale from 1 (*never or very rarely true*) to 5 (*very often or always true*) and assess five key components of mindfulness skills: Non-Reactivity to Inner Experience (e.g., "When I have distressing thoughts or images, I just notice them and let them go"), Observing/Noticing (e.g., "I notice the smells and aromas of things"), Acting with Awareness (e.g., "I find myself doing things without paying attention"), Describing (e.g., "I am good at finding words to describe my feelings") and Non-Judging of Experience (e.g., "I disapprove of myself when I have illogical ideas"). All mindfulness facets have been found to significantly correlate with positive mental health and are sensitive to change (Bohlmeijer et al., 2011; Carmody & Baer, 2007). As an exploratory measure, subscales were combined into a total score for analysis. In the current study, internal consistency on the subscales ranged from $\alpha$ = .88 to .90.

**Perceived Stress.** The Perceived Stress Scale (PSS; Cohen et al., 1983) is a widely used instrument for measuring the degree to which a life situation is perceived as stressful. Studies using this measure in non-diet programs have shown significant reductions in perceived stress following treatment (e.g., Carmody & Baer, 2007;). In the current study, the 10 items were rated on a Likert-type scale from 1 (*never)* to 6 (*always*). An example item includes: "In the last month, how often have you found that you could not cope with all the things that you had to do?" In the current study, the PSS item's internal consistency ranged from $\alpha$ = .88 to .96.

**Physical Activity.** We included two measures that assess levels of physical activity and sendentary behavior: the Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985) and two items from the International Physical Activity Questionnaire (IPAQ;

Craig et al., 2003). The GLTEQ is a widely used brief measure that contains four items measuring the frequency of strenuous, moderate, and mild physical activity. Two week test-retest reliability coefficients were $r$ = .94 (strenuous), .46 (moderate), and .48 (light; Godin & Shephard, 1985). To measure participants' sedentary behavior, two IPAQ items were selected that assess sitting time on a typical weekday and weekend day (i.e., "During the last 7 days, how much time did you spend sitting on a typical weekday?"). Total minutes per week were calculated. The IPAQ's sitting time items have been found to be related to the Sedentary Behavior Questionaire (partial $r$ = .54) and show adequate test-retest reliability ($r$ = .75 to .82; Rosenberg et al., 2010).

**Manipulation Check, Treatment Fidelity, and Attendance**.

A manipulation check was developed to evaluate whether participants in the IE group increased in their knowledge of IE principles. Six multiple-choice items were included (e.g., "Which of the following are principles of Intuitive Eating?") on the post-treatment assessment (Time 2). One would expect to see a difference in individuals' scores between the IE intervention group and the wait-list control if the IE principles were adequately taught and learned. Additionally, to ensure adherence to the treatment manual and consistency across treatment sessions and groups, a trained graduate student observed each intervention session and noted any deviation from the manual's treatment protocol. Intervention guidelines set by the dietitian required participants to attend a minimum of six session to receive credit of completion. These same guidelines were followed for inclusion criteria for the final analysis, as six sessions was considered an adequate dose.

## Statistical Analysis

The IBM Statistical Package for Social Sciences (SPSS v. 25) was used for all analyses. Descriptive statistics were calculated to examine participant characteristics. Outliers were identified if they were three standard deviations above or below the mean and adjusted to match the next closest score. Baseline differences between the IE and control group were examined using chi-square ($\chi^2$) for categorical data (e.g., sex) and *t*-tests for continuous data (e.g., age). Additionally, individuals who completed at least six intervention sessions (completers) were compared to those who completed less than six sessions (non-completers) on outcome variables measured at baseline using *t*-tests and Cohen's *d* effect sizes.

Each outcome was analyzed using multilevel modeling (MLM) for repeated measures data. MLM was used to examine the within-subjects variation and between-subjects variation where Level 1 contains the repeated outcome measures nested within Level 2, the intervention groups. Each model included three predictors: treatment group (between factor), time (within factor), and the group-by-time interaction. Models were estimated using unstructured covariance (UC) matrices and restricted maximum likelihood (REML) estimation, which is recommended for estimating the covariance structure when the number of groups is small (Boedeker, 2017). For each variable analyzed, the model was built progressively from the baseline model with group, group by time interaction, and baseline BMI as a covariate being added in each subsequent model. Because model convergence was a problem for most variables (likely due to the small sample size and that change over time was nonlinear), time was then treated as a categorical predictor variable and transformed into dummy coded variables. Two dummy codes were used (*k*-1 degrees of freedom) with Time 1 serving as the reference point, so differences between groups over time were compared from baseline to post-intervention (T2-T1) and

baseline to follow-up (T3-T1). This resolved problems with model convergence, and improved model fit (though improvements in fit were mostly not statistically significant; see Results). An example of the SPSS syntax for IES-2 can be found in Appendix C. Comparative model fit indices, including Akaike's Information Criteria (AIC), and chi-square likelihood ratio test interpreted by the deviance (-2LL) were used to compare the change in the models. Effect sizes (Cohen's *d*) for the magnitude of between group changes across time were estimated using covariate adjusted means, where $Y$ = Intercept + $B$(group) + $B$(t2) + $B$(t3) + $B$(t2*group) + $B(M_{BMI})$, along with the unadjusted pooled *SD*.

## Results

### Participants

Of the 50 randomized participants, eight did not consent to participate in the study leaving 20 participants in the WL group and 22 in the IE group. Of the 22 IE participants, four missed one of the three surveys. From the WL participants, one missed one survey and one missed two surveys (Figure 1). From the 22 IE participants, seven were excluded due to attending less than six sessions. There were no statistically significant differences between IE completers ($n$ = 15) and non-completers ($n$ = 7) on any baseline variables assessed; however, the magnitude of these differences were moderate to large on many variables (Table 1). No consistent pattern emerged, though, as non-completers reported higher BMI, less weight management self-efficacy, less physical activity, but also greater well-being, more mindfulness, and were less sedentary.

The final sample included 35 participants: 20 participants in the WL group and 15 in the IE intervention group. This sample was comprised of 91.4% identifying as Caucasian/White and 88.6% as female. The sample had a mean age of 48.74 (*SD* = 11.27) years and mean BMI of

30.12 (*SD* = 6.83) upon starting the intervention. Additionally, the sample was well educated, with 57.1% holding a graduate degree and 30.6% holding faculty positions.

The final IE participants (*n* = 15) and WL participants (*n* = 20) were compared at baseline on all demographic and outcome variables. Descriptive statistics for all demographic measures by group appear in Table 2. There were no statistically significant differences between the two groups on any of the demographic or outcome variables.

**Correlations between measures**

IES-2 total score was related to various eating and body-related measures and psychological well-being (see Table 3). Specifically, at baseline the IES-2 total score was significantly ($p < .001$) positively correlated with efficacy to control eating and manage weight, as well as body satisfaction, and negatively correlated with BMI, and interoceptive awareness of hunger cues. BMI was also significantly ($p < .001$) negatively correlated with the same variables with the addition of life satisfaction. Notably, work absenteeism was not significantly correlated with any outcome measures.

**Outcome Analyses**

Multilevel modeling was used to examine differences between the intervention and control group over the 8 week intervention program on IE. The final model (group by time interaction controlling for BMI with time dummy coded), had a lower -2LL than prior models, though the change in $X^2$ was not significant, indicating that adding the dummy coding time of time and the interaction effect did not significantly change the model fit. However, given that the main interest of this research study was the group comparison over time (i.e., interaction effect), and the inclusion of the additional terms did not decrease the model fit, we proceeded to interpret the final model's results. See Table 4 for final model results of all variables.

Intuitive eating, as measured by the IES-2 total score, controlling for BMI, revealed that the group-by-time interaction for T1 to T2 was statistically significant ($p = .049$, $d = 0.57$) with the IE group showing moderately greater improvements in their tendency to eat in accordance with IE principles. The group-by-time interaction on IES-2 for T1 to T3 was not statistically significant ($p = .16$), though the effect size ($d = 0.49$) was moderate. There was no significant increase in IES-2 score between groups from T2 to T3 ($p = .87$, $d = -0.04$). Thus, the use of IE approaches for the intervention group did not show continued improvement after the intervention ended, though the initial gains appear potentially maintained. In terms of model fit, the change from null to final model was significant ($X^2 = 15.82$, $p < .05$).

The tendency to eat according to one's hunger and satiety cues (as measure by the IAQ-E total score), revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not statistically significant ($p = .10$), though the effect size indicated that the IE group showed a small decrease in IAQ-E scores (i.e., an increase in interoceptive awareness) as compared to the WL group ($d = -0.36$). The group-by-time interaction for the IAQ-E for T1 to T3 was also not statistically significant, $p = .08$, but again the IE group continued to show a small to moderately greater change than the WL group ($d = -0.45$). There was no significantly different change in IAQ-E between groups from T2 to T3 ($p = .63$, $d = -0.09$). For model fit, the change from null to final model was significant ($X^2 = 24.21$, $p < .01$).

Perceived competence for managing weight revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not significant ($p = .20$), though the IE group showed a small effect in improvements in their perceived confidence to change or maintain weight compared to the WL group ($d = 0.34$). The group-by-time interaction on weight management perceived competence for T1 to T3 was not statistically significant ($p = .69$) with no meaningful

improvement for those in the intervention versus control group ($d = 0.11$). There was no significant change in perceived competence ratings between groups from T2 to T3 ($p = .38$, $d = -0.21$). The change from null to final model for this variable was significant ($X^2 = 23.84$, $p < .01$).

Self-efficacy regarding eating behaviors revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not significant, $p = .53$, with the IE group showing no meaningful improvements ($d = 0.19$) in participants' self-efficacy about their eating behaviors as compared to the WL group. The group-by-time interaction for T1 to T3 was also not significant ($p = .42$, $d = 0.24$). Furthermore, there was no significant increase in self-efficacy ratings between groups from T2 to T3 ($p = .82$, $d = 0.05$). The change from null to final model for this variable was significant ($X^2 = 26.34$, $p < .01$).

Although both groups reported greater body satisfaction at T2, the group-by-time interaction for T1 to T2, controlling for BMI, was not significant ($p = .61$) with the IE group showing no meaningfully greater improvements than the WL group ($d = 0.09$). The group-by-time interaction on body satisfaction for T1 to T3 was also not statistically significant ($p = .12$) though the effect size ($d = 0.37$) was small, suggesting the IE group may have eventually experienced some improved body satisfaction compared to the WL group. There was no significant change in body satisfaction score between groups from T2 to T3 ($p = .17$) with a small effect size ($d = 0.27$). Thus, the IE group made small improvements in body satisfaction, albeit not statistically significant, from the beginning of treatment to the follow-up as compared to the WL group. In terms of model fit, the change from null to final model was significant ($X^2 = 53.83$, $p < .01$).

Work absenteeism controlling for BMI, revealed that the group-by-time interaction for T1 to T2 was not significant ($p = .16$) with a medium effect size ($d = 0.66$). The group-by-time

interaction for absenteeism for T1 to T3 was statistically significant ($p = .03$) with a large effect size ($d = 0.98$). There was no significant difference in absenteeism between groups from T2 to T3 ($p = .46$, $d = 0.32$). The final model was a significant improvement from the null ($X^2 = 12.73$, $p < .05$).

In terms of BMI, the group-by-time interaction for T1 to T2 was not significant ($p = .33$) with only a small effect ($d = -0.25$) for the IE group compared to the WL group. The group-by-time interaction for T1 to T3 was also not statistically significant ($p = .86$). There was no significant change in BMI between groups from T2 to T3 ($p = .46$, $d = 0.04$). The final model was not a significant improvement from the null at the .01 level ($X^2 = 3.20$, $p > .05$).

Life satisfaction, as measured by one item from the Personal Wellbeing Index, revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not significant ($p = .72$) with the IE group showing no meaningfully ($d = 0.10$) greater improvements than the WL group. The group-by-time interaction on life satisfaction for T1 to T3 was also not statistically significant ($p = .91$, $d = 0.05$). There was no significant increase in life satisfaction between groups from T2 to T3 ($p = .90$, $d = -0.04$). Model fit for this variable showed a significant improvement from the null ($X^2 = 14.12$, $p < .05$).

**Exploratory Outcome Measures**

Perceived stress as measured by the PSS, revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not significant ($p = .39$, $d = 0.22$). The group-by-time interaction on PSS for T1 to T3 was statistically significant ($p = .03$) with a large effect size ($d = -0.80$) as was T2 to T3 ($p = .01$, $d = -1.00$), indicating that the WL group reported a much greater increase in stress at the T3 follow-up. In terms of model fit, the change from null to final model was significant ($X^2 = 37.72$, $p < .01$).

Physical activity as measured by the GLTEQ revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not significant, ($p$ = .42, $d$ = -0.21). The group-by-time interaction for T1 to T3 was not statistically significant, ($p$ = .31) with a small effect size ($d$ = -0.30). The final model for this variable was a significant improvement from the null ($X^2$ = 30.86, $p$ < .01). However, sedentary behavior, as measured by two items from the IPAQ, revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was significant, ($p$ = .03) with a medium effect size ($d$ = -0.62). Thus, the IE group showed a greater reduction in sedentary behavior than that WL group over the intervention period. The group-by-time interaction on IPAQ for T1 to T3 was not statistically significan, ($p$ = .24, $d$ = -0.40) nor was the T2 to T3 comparison, ($p$ = .55, $d$ = 0.23). In terms of model fit, the change from null to final model was significant ($X^2$ = 59.57, $p$ = .01).

Mindfulness, as measured by the FFMQ-SF, revealed that the group-by-time interaction for T1 to T2, controlling for BMI, was not significant ($p$ = .99, $d$ = 0.00). The group-by-time interaction for T1 to T3 was not statistically significant ($p$ = .36) with no meaningful effect ($d$ = 0.19). There was no significant increase in total overall mindfulness ratings between groups from T2 to T3 ($p$ = .27, $d$ = 0.21). The final model for this variable was a significant improvement from the null ($X^2$ = 27.50, $p$ < .01).

**Manipulation Check**

As a manipulation check, examination of the knowledge questions revealed that the IE group answered more questions about IE correctly ($M$ = 4.20, $SD$ = .82), compared to the WL group ($M$ = 2.45, $SD$ = 1.54) following the intervention, $t$(28.55) = 4.27, $p$ < .001, $d$ = 1.42. This finding indicates, as anticipated, that the IE intervention was effective with teaching IE principles.

## Discussion

The current study aimed to evaluate the effectiveness of IE as a preventative strategy for weight gain and dysregulated eating behaviors. As seen through participants' scores on the knowledge questions, the IE intervention was effective in teaching participants about IE. By incorporating IE skills and lifestyle behaviors through the application of Tribole and Resch's guidelines, participants in the intervention were predicted to increase their healthy eating behaviors and have better IE, appetite awareness, self-efficacy related to eating, weight management perceived competence, body satisfaction, life satisfaction, and less weight gain by post intervention and 6-month follow-up compared to the control group. We expected that those in the IE intervention would respond better to external eating cues and rely more on their internal appetite cues thus supporting weight stability and preventing unintended weight gain. Although the IE intervention seemed to modestly increase participants' awareness and knowledge of eating intuitively, it did not appear more effective than no treatment across most other variables.

Similar to findings of other studies (e.g., Tylka, 2006; Tylka & Diest, 2013), greater IE at baseline was associated with generally higher levels of body health such as perceived competence in weight management, body parts satisfaction, interoceptive sensitivity, and lower BMI. Less clear is whether participating in the IE program had meaningful effects on these, and other, important outcomes.

Much of the key content of the IE intervention delivered in this study emphasized strategies to improve awareness of eating related thoughts and behaviors. Not surprisingly, then, the largest effect of the intervention was detected with IE scores ($d$ = 0.57). This effect, though, was smaller compared to two other studies using a similar version of the intervention (Bush et al., 2014, $\eta^2$ = .36; Cole & Horacek, 2010, $d$ = 1.78). Although both of those interventions

involved 10 sessions (vs. 8 in the present study), it seems unlikely that two additional sessions would have contributed that substantial of an effect on ability to eat intuitively. An alternative explanation involves measurement differences for one study -- Cole and Horacek (2010) assessed IE using a survey comprised of items relating to diet mentality (e.g., impact of food choices, self-image, dieting habits, self-efficacy). Alternatively, the lack of a true control group in the Bush et al. (2014) study might explain the difference. It may also be that those interventions were delivered more effectively, or participant characteristics influenced changes. For example, our sample received wellness points from the University's healthcare program for participation, so perhaps not all participants were motivated by the desire to change their behavior.

Along with IE, it was expected that participants in the IE group would demonstrate an increase in their appetite awareness and ability to follow their appetite cues in the face of negative emotions or social influence. In fact, the topic of emotional eating was a common concern brought up by participants in the intervention and thus regularly addressed in weekly sessions. Despite this, the intervention group did not show any significant improvements ability to detect hunger and satiety cues over time compared to the control group. Though there was a small effect size at post intervention compared to the control group ($d$ = -.36), suggesting the current investigation may be underpowered to detect small intervention effects.

Our finding that weight management perceived confidence and weight efficacy scores among the intervention group were not substantially more improved than the control group was surprising, given findings from other intervention studies (Hawley et al., 2008; Katzer et al., 2008). These other studies had similar components to our intervention including relying on appetite cues and body acceptance; however, these programs lasted almost a year and had

additional treatment approaches, including daily monitoring of food and exercise. These additional intervention strategies could account for the increased weight self-efficacy as consistent dietary self-monitoring is associated with greater self-efficacy and improved weight control (Burke et al., 2011; Schnoll & Zimmerman, 2001).

Additionally, with the intervention's focus on body appreciation, it was predicted that participants in the IE group would show a greater increase in body satisfaction than the control group. Whereas this was not supported in the current study, previous studies (e.g., Bush et al., 2014; Gagnon-Girouard et al., 2010) report significantly higher levels of body satisfaction at post intervention. One key consideration that may account for this difference is that body image is a multidimensional construct and numerous measures exist to assess these distinct components (e.g., Kling et al., 2019). Our study used the Body Parts Satisfaction Scale whereas the Body Appreciation Scale and Body-Esteem Scale were used in Bush's (2014) and Gagnon-Girouard's (2010) studies, respectively. Therefore, although these instruments all assess body image-related constructs, they may measure uncorrelated dimensions thus receiving different ratings. The fact that body image consists of conceptual different aspects, such as body dissatisfaction and positive body image (Tylka & Wood-Barcalow, 2015), warrants future intervention studies to use either multiple measures to get at multiple factors of body image or use a measure that appropriately focuses on the aspects targeted in the intervention.

There was no significant effect in well-being, perceived stress, or mindfulness for exploratory outcomes, though all participants showed a slight improvement over time. One hypothesis is that these were not major focuses of the intervention compared to other studies. For example, several studies that included mindfulness components in their program demonstrated significant increases in mindfulness, decreases in perceived stress (Carmody & Baer, 2007;

Cavanagh et al., 2013; Dalen et al., 2010), and increases in well-being (Carmody & Baer, 2007; Dalen et al., 2010) over time compared to control groups.

Lastly, it does not appear that IE is associated with higher levels of physical activity which is consistent with similar intervention studies (e.g., Cole and Horacek, 2010; Leblanc et al., 2012; Provencher et al., 2009). Therefore, unless an IE program places a larger emphasis on physical activity as part of improving health it is unlikely participants would exhibit an increase in exercise. Interestingly, although participants did not show meaningful difference in physical activity, those in the IE group reported significantly lower levels of sedentary behaviors from baseline to post intervention compared to the WL group. This could be due to the program's week 7's theme "Movement For Fun" which focused on combating negative self-talk about not engaging in strenuous exercises and instead introduces a positive relationship with body movement.

**Limitations**

The current study attempted to address several limitations from prior studies. For instance, the study improved upon past studies by attempting to utilize group randomization and including a 6 month follow-up to assess potential gains and/or maintenance of intervention outcomes. Despite these efforts to improve upon past investigations of IE interventions, there are several limitations to this study that should be considered. Of note, we had small sample sizes for both intervention and control groups. Post hoc power analysis using G*Power (Faul et al., 2007), for a 2 group x 3 timepoint repeated measures design for 35 participants (alpha = .05, estimated correlation of $r$ = .5 between measures over time), indicated that the study was adequately powered to detect medium ($f$ = 0.25; 90% power) and large effects ($f$ = 0.40; 95% power), but not small effects ($f$ = 0.10; 23% power). Thus, if actual change in many outcomes

are likely to be small from our IE intervention, our study did not have enough participants to reliably detect such changes. This limited statistical power may have also reduced our ability to observe pre-existing group differences on select characteristics at baseline, despite our efforts with randomization. Furthermore, random assignment of participants occurred prior to the actual study consent procedures. Thus, the meaning of the participants' refusal is unknown as well as how the lost data could have altered the two conditions. Regarding attrition, the baseline BMI of non-completers was significantly higher compared to participants who competed the intervention. A possible explanation of this difference is those with a higher BMI may not have accepted the rational for IE especially if they felt previous societal and medical pressures to adopt a weight loss goal.

Another limitation is that although our study had a control group, the participants were not told to abstain from engaging in other dietary or weight loss programs and we did not ask about this. This may have altered the data gathered from the control group if participants were taking part in another program. Finally, the use of self-report measures in measuring outcomes and its subjectivity to response bias is a limitation of the study. Definitions of many concepts used in the survey were not provided to the participants which therefore such terms were left to subjective interpretation of the individual. A recalibration of standards, or 'response-shift bias' (Howard, 1980), may have occurred post-treatment when the individual gained more understanding or awareness of item concepts and their estimation of their level of engaging in such behaviors. This process can confound the treatment effects and the internal validity of results as respondents' metric, or standard frame of reference, for targeted behaviors may have varied across time points (Howard, 1980). Also, social desirability may have decreased over the

course of the intervention as respondents come to know and trust the dietitian leading the group and understand the benefit of providing accurate feedback.

**Future Directions**

There are several possible worthwhile future directions for this area of research. One would be to recruit a larger sample size over a longer period of time (more than 6 months) in order to allow for more complex growth modeling to allow for changes and interaction in predictors as well as detect meaningful long term salience of outcomes. Additionally, IE was shown to be associated with positive psychological health factors and therefore it may be beneficial for studies to include questions about ease or difficulty participants find to eat intuitively. For though participants showed as increase in IE knowledge, it was less clear whether they were able to successfully practice IE. Understanding more about how and why people eat intuitively could help determine factors that may make it more difficult for participants to adhere to IE principles. Furthermore, IE alone may not be effective without additional components such as mindfulness or strategies targeting self-efficacy to change. For example, although not part of Tribole and Resch's program, future studies may want to consider requiring participants to monitor their daily food and exercise and for topics to be repeatedly covered throughout the entirety of the program. Monitoring activity has shown to be an essential component in improving participants' confidence and self-efficacy in weight management programs (Burke et al., 2011; Schnoll & Zimmerman, 2001) which has in return shown to improve the effectiveness of participants reaching their personal weight loss goals (Carlton, 2017). These programs included integrative health coaching with the coaches focusing on eliciting internal motivation for health goals and increase patients' autonomy, resilience, and self-efficacy to change (Simmons & Wolever, 2013).

## Conclusion

Intuitive eating interventions may provide a potential alternative approach to traditional dietary programs, though additional larger scale investigations are needed to demonstrate clearer empirical evidence. The IE intervention used in this study appeared modestly effective in increasing participants' awareness and knowledge of eating intuitively but did not appear more effective than no treatment in most other ways. Future studies may also benefit from exploring other non-dieting intervention components, with efforts targeting increased self-efficacy to change, as well as increasing the durability of effects following completion of IE training.

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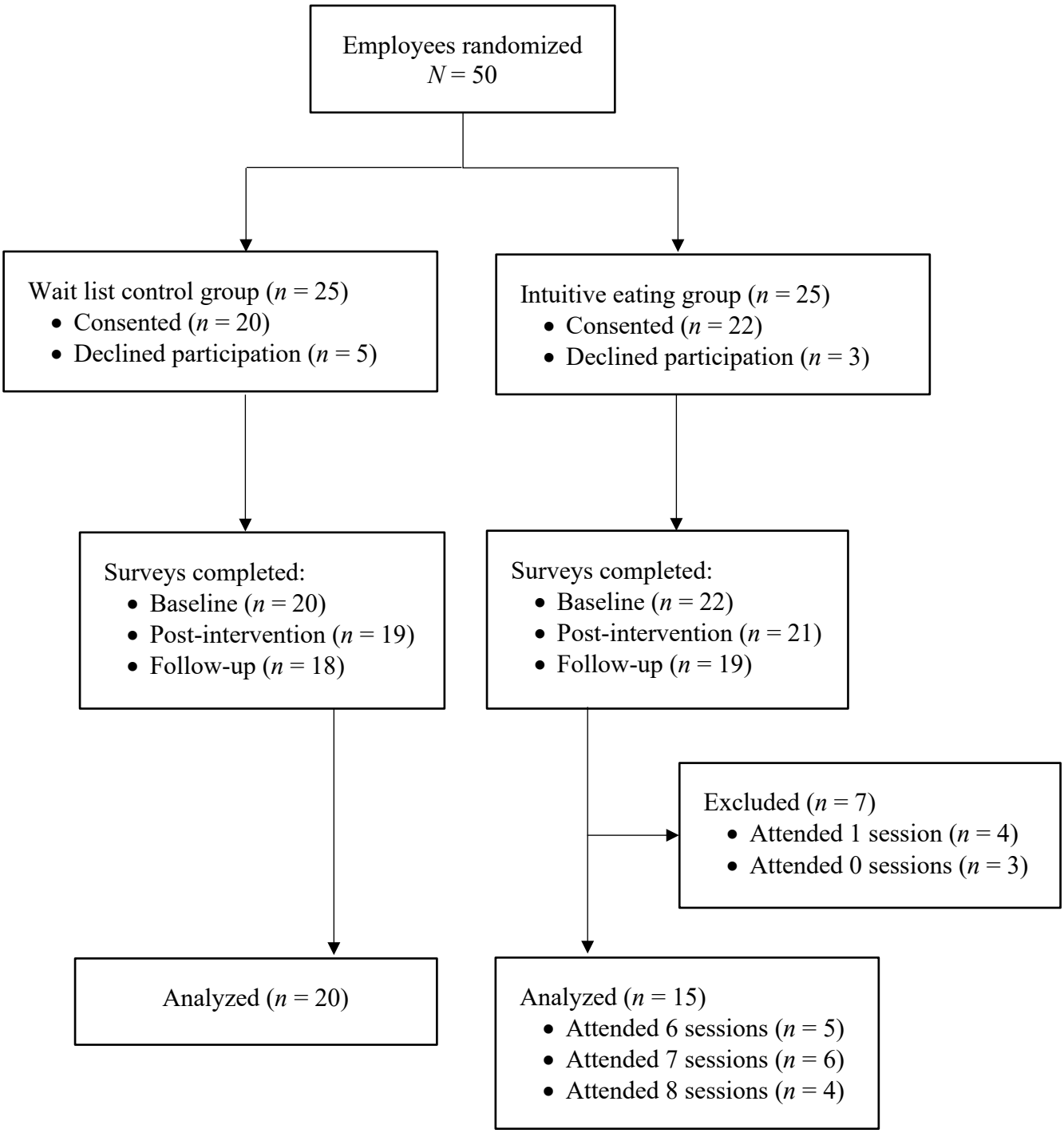


*Figure 1.* Participant Flow Chart

**Table 1**

*Completers vs Non-Completers Across Baseline Measures*

| Variable | Completers (*n = 15*) *M (SD)* | Non-completers (*n = 7*) *M (SD)* | *t* | *p* | *d* |
|---|---|---|---|---|---|
| IES-2 | 3.01 (0.48) | 2.86 (0.44) | 0.68 | .50 | 0.31 |
| IAQ | 2.77 (0.54) | 3.06 (0.68) | -1.11 | .28 | -0.51 |
| WELQ | 6.15 (1.69) | 6.32 (1.21) | -0.24 | .81 | -0.11 |
| BPSS | 1.99 (0.87) | 1.77 (0.53) | 0.62 | .54 | 0.29 |
| IPAQ | 3782 (1483.34) | 3000 (884.53) | 1.28 | .21 | 0.59 |
| GLTEQ | 41.54 (20.95) | 33.57 (21.03) | 0.82 | .42 | 0.38 |
| FFMQSF | 3.36 (0.38) | 3.56 (0.33) | -1.22 | .24 | -0.56 |
| Absenteeism | 1.40 (4.17) | 0 (0) | 0.88 | .39 | 0.40 |
| BMI | 31.60 (6.68) | 37.05 (6.60) | -1.79 | .09 | -0.82 |
| PSS | 3.41 (0.70) | 3.36 (0.64) | 0.16 | .88 | 0.07 |
| PWI | 6.73 (1.62) | 7.86 (0.38) | -1.79 | .09 | -0.82 |
| WMPC | 3.17 (1.10) | 2.64 (0.85) | 1.11 | .28 | 0.51 |

*Note.* Completers include participants who participated in at least 6 intervention sessions. Non-completers include participants who did not participate in at least 6 intervention sessions. IES-2 = Intuitive Eating Scale-2; IAQ = Interoceptive Awareness Questionnaire; WELQ = Weight Efficacy Lifestyle Questionnaire; BPSS = Body Parts Satisfaction Scale; IPAQ = International Physical Activity Questionnaire; GLTEQ = Godin Leisure-Time Exercise Questionnaire; FFMQSF = Five-Facet Mindfulness Questionnaire Short Form; Absenteeism = Missed Work Hours; BMI = Body Mass Index; PSS = Perceived Stress Scale; PWI = Personal Wellbeing Index; WMPC = Weight Management Perceived Competence Scale.

**Table 2**

*Demographics and Weight History of Participants at Baseline*

| Variable | Total | | IE Group | | WL Group | | *t* | *p* |
|---|---|---|---|---|---|---|---|---|
| | *M (SD)* | | *M (SD)* | | *M (SD)* | | | |
| Age | 48.74 (11.27) | | 47.27 (10.62) | | 49.85 (11.87) | | -0.68 | .51 |
| BMI | 30.12 (6.83) | | 31.60 (6.68) | | 29.02 (6.91) | | 1.11 | .28 |
| | *n* | *%* | *n* | *%* | *n* | % | $X^2$ | *p* |
| Sex | | | | | | | 1.91 | .17 |
| Male | 4 | 11.4 | 3 | 20 | 1 | 5 | | |
| Female | 31 | 88.6 | 12 | 80 | 19 | 95 | | |
| Race/ethnicity | | | | | | | 2.69 | .10 |
| Native American | 2 | 5.7 | 2 | 13.3 | 0 | 0 | | |
| White, Non-Hispanic | 32 | 91.4 | 13 | 86.7 | 19 | 95 | | |
| Other | 1 | 2.9 | 0 | 0 | 1 | 5 | | |
| Education | | | | | | | 2.15 | .34 |
| Some college | 2 | 5.7 | 0 | 0 | 2 | 10 | | |
| College degree | 11 | 31.4 | 4 | 26.7 | 7 | 35 | | |
| Graduate/professional | 22 | 62.9 | 11 | 73.3 | 11 | 55 | | |
| Days/wk ate breakfast | | | | | | | 6.02 | .30 |
| Less than 6 days | 8 | 22.9 | 3 | 20 | 5 | 25 | | |
| 6 or more | 27 | 77.1 | 12 | 80 | 15 | 75 | | |

| Variable | Total | | IE Group | | WL Group | | $X^2$ | $p$ |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | | |
| Eating between meals | | | | | | | 1.11 | .76 |
| Daily | 18 | 51.4 | 9 | 60 | 9 | 45 | | |
| Less than daily | 17 | 48.6 | 6 | 40 | 11 | 55 | | |
| Servings of fruit last month | | | | | | | 0.29 | .96 |
| At least twice per day | 13 | 37.1 | 6 | 40 | 7 | 35 | | |
| Once per day or less | 22 | 62.9 | 9 | 60 | 13 | 65 | | |
| Servings of vegetables last month | | | | | | | 3.70 | .30 |
| At least twice per day | 20 | 57.1 | 8 | 53.3 | 12 | 60 | | |
| Once per day or less | 15 | 42.9 | 7 | 46.7 | 8 | 40 | | |
| Weighing frequency | | | | | | | 10.46 | .06 |
| Daily | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Weekly | 11 | 31.4 | 8 | 53.3 | 3 | 15 | | |
| Monthly | 7 | 20 | 2 | 13.3 | 5 | 25 | | |
| Every couple months | 15 | 42.9 | 4 | 26.7 | 11 | 55 | | |
| Once per year /or Less | 2 | 5.7 | 1 | 6.7 | 1 | 5 | | |

*Note*. Total $n = 35$, IE group $n = 15$, wait list control group $n = 20$.

**Table 3**

*Intercorrelations of the Measured Variables at Baseline*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. IES-2 | — | | | | | | | | | | |
| 2. IAQ | -.66** | — | | | | | | | | | |
| 3. WMPC | .35** | -.50** | — | | | | | | | | |
| 4. WELQ | .68** | -.55** | .59** | — | | | | | | | |
| 5. BPSS | .49** | -.51** | .71** | .47** | — | | | | | | |
| 6. BMI | -.42** | .38** | -.54** | -.50** | -.69** | — | | | | | |
| 7. PSS | -.09 | .04 | .07 | -.16 | -.06 | .06 | — | | | | |
| 8. GLTEQ | -.04 | -.08 | .29** | .06 | .24* | -.19 | .03 | — | | | |
| 9. IPAQ | -.06 | .25* | -.28** | -.18 | -.24* | .07 | .12 | -.42** | — | | |
| 10. FFMQ | .43** | -.43** | .24* | .45** | .32** | -.25* | -.49** | -.00 | -.28** | — | |
| 11. Absent. | .06 | .04 | .11 | .13 | .12 | -.09 | .17 | -.01 | .00 | -.17 | — |
| 12. PWI | .20 | -.15 | .20 | .35** | .30** | -.39** | -.41** | .30** | -.18 | .38** | -.14 |

*Note.* *$p < .05$; **$p < .001$; IES-2 = Intuitive Eating Scale-2; IAQ = Interoceptive Awareness Questionnaire; WMPC = Weight Management Perceived Competence Scale; WELQ = Weight Efficacy Lifestyle Questionnaire; BPSS = Body Parts Satisfaction Scale; BMI = Body Mass Index; PSS = Perceived Stress Scale; GLTEQ = Godin Leisure-Time Exercise Questionnaire; IPAQ = International Physical Activity Questionnaire; FFMQ = Five-Facet Mindfulness Questionnaire Short Form; Absent. = Missed Work Hours; PWI = Personal Wellbeing Index

**Table 4**

*Means, Standard Deviations, and Group x Time Interaction Effects for Outcome Variables*

| Variable | IE Group | WL Group | T2 - T1 | | | T3 - T1 | | | T3 - T2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M (SD)* | *M (SD)* | *F* | *p* | *d* | *F* | *p* | *d* | *F* | *p* | *d* |
| IES-2 | | | | | | | | | | | |
| Baseline | 3.01 (0.48) | 3.12 (0.41) | 4.18 | .05 | 0.57 | 2.04 | .16 | 0.49 | 0.03 | .87 | -0.04 |
| Post | 3.28 (0.40) | 3.13 (0.46) | | | | | | | | | |
| 6m follow-up | 3.18 (0.46) | 3.11 (0.52) | | | | | | | | | |
| IAQ | | | | | | | | | | | |
| Baseline | 2.77 (0.54) | 2.64 (0.72) | 2.91 | .10 | -0.36 | 3.23 | .08 | -0.45 | 0.24 | .63 | -0.09 |
| Post | 2.46 (0.26) | 2.56 (0.63) | | | | | | | | | |
| 6m follow-up | 2.47 (0.33) | 2.66 (0.52) | | | | | | | | | |
| WMPC | | | | | | | | | | | |
| Baseline | 3.17 (1.10) | 3.78 (1.65) | 1.69 | .20 | 0.34 | 0.16 | .69 | 0.11 | 0.79 | .38 | -0.21 |
| Post | 3.50 (1.18) | 3.61 (1.55) | | | | | | | | | |
| 6m follow-up | 3.29 (1.41) | 3.72 (1.60) | | | | | | | | | |
| WELQ | | | | | | | | | | | |
| Baseline | 6.15 (1.69) | 6.77 (1.53) | 0.41 | .53 | 0.19 | 0.68 | .42 | 0.24 | 0.05 | .82 | 0.05 |
| Post | 6.61 (1.40) | 6.84 (1.87) | | | | | | | | | |
| 6m follow-up | 6.30 (1.57) | 6.55 (1.81) | | | | | | | | | |

| Variable | IE Group | WL Group | T2 – T1 | | | T3 – T1 | | | T3 – T2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M (SD)* | *M (SD)* | *F* | *p* | *d* | *F* | *p* | *d* | *F* | *p* | *d* |
| BPSS | | | | | | | | | | | |
| Baseline | 1.99 (0.87) | 2.44 (0.85) | 0.26 | .61 | 0.09 | 2.63 | .12 | 0.37 | 1.94 | .17 | 0.27 |
| Post | 2.45 (0.83) | 2.69 (1.03) | | | | | | | | | |
| 6m follow-up | 2.46 (1.02) | 2.55 (1.01) | | | | | | | | | |
| Absenteeism | | | | | | | | | | | |
| Baseline | 0.87 (2.23) | 2.35 (3.48) | 2.12 | .16 | .66 | 5.51 | .03 | .98 | 0.56 | .46 | .32 |
| Post | 1.80 (3.30) | 1.37 (2.99) | | | | | | | | | |
| 6m follow-up | 2.29 (3.41) | 1.18 (2.74) | | | | | | | | | |
| BMI | | | | | | | | | | | |
| Baseline | 31.60 (6.68) | 29.02 (6.91) | 0.98 | .33 | -0.25 | 0.03 | .86 | -0.01 | 0.57 | .46 | 0.04 |
| Post | 31.32 (6.98) | 29.38 (6.79) | | | | | | | | | |
| 6m follow-up | 32.04 (7.26) | 28.29 (5.62) | | | | | | | | | |
| PWI | | | | | | | | | | | |
| Baseline | 6.73 (1.62) | 7.35 (0.99) | | | | | | | | | |
| Post | 7.07 (1.94) | 7.47 (1.31) | | | | | | | | | |
| 6m follow-up | 6.64 (2.17) | 7.18 (1.55) | 0.14 | .72 | 0.10 | 0.01 | .91 | 0.05 | 0.02 | .90 | -0.04 |

| Variable | IE Group | WL Group | T2 – T1 | | | T3 – T1 | | | T3 – T2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M (SD)* | *M (SD)* | *F* | *p* | *d* | *F* | *p* | *d* | *F* | *p* | *d* |
| PSS | | | | | | | | | | | |
| Baseline | 3.41 (0.70) | 3.09 (0.61) | 0.75 | .39 | 0.22 | 4.88 | .03 | -0.80 | 8.67 | .01 | -1.00 |
| Post | 3.07 (0.71) | 2.73 (0.73) | | | | | | | | | |
| 6m follow-up | 3.25 (0.34) | 3.39 (0.27) | | | | | | | | | |
| FFMQSF | | | | | | | | | | | |
| Baseline | 80.53 (9.08) | 80.20 (15.37) | 0.00 | .99 | -0.00 | 0.86 | .36 | 0.19 | 1.28 | .27 | 0.21 |
| Post | 83.47 (9.86) | 82.58 (12.48) | | | | | | | | | |
| 6m follow-up | 86.93 (8.22) | 84.06 (12.56) | | | | | | | | | |
| IPAQ (min) | | | | | | | | | | | |
| Baseline | 3782.00 (1483.34) | 3240.00 (1025.10) | 5.47 | .03 | -0.62 | 1.44 | .24 | -0.40 | 0.36 | .55 | 0.23 |
| Post | 2480.00 (1179.56) | 2742.37 (758.91) | | | | | | | | | |
| 6m follow-up | 3192.86 (1240.88) | 3188.82 (813.93) | | | | | | | | | |
| GLTEQ | | | | | | | | | | | |
| Baseline | 41.54 (20.95) | 36.05 (19.67) | 0.66 | .42 | -0.21 | 1.08 | .31 | -0.30 | 0.10 | .76 | -0.07 |
| Post | 45.03 (29.47) | 45.68 (26.83) | | | | | | | | | |
| 6m follow-up | 40.93 (31.83) | 42.65 (24.32) | | | | | | | | | |

*Note.* Unadjusted values reported for means and standard deviations. Effect sizes are based on adjusted means and unadjusted SDs, All group*time analyses are based on BMI covariate-adjusted scores. IES-2 = Intuitive Eating Scale-2; IAQ = Interoceptive Awareness Questionnaire; WELQ = Weight Efficacy Lifestyle Questionnaire; BPSS = Body Parts Satisfaction Scale; IPAQ = International Physical Activity Questionnaire; GLTEQ = Godin Leisure-Time Exercise Questionnaire; FFMQSF = Five-Facet Mindfulness Questionnaire Short Form; BMI = Body Mass Index; PSS = Perceived Stress Scale; PWI = Personal Wellbeing Index; WMPC = Weight Management Perceived Competence Scale.

# Appendix A

*Intuitive Eating Intervention*

| Week | Theme | IE Topics | Exercises/Activities |
|---|---|---|---|
| 1 | Food Beliefs | Dieting, Food Rules/Beliefs, Intro to IE | Reflect on your Dieting Experiences; Listing Food Rules |
| 2 | Hunger & Satiety | Hunger and Satiety Cues, Types of Hunger, Triggers | Reflect on Hunger/Satiety Cues; Practice using the Hunger Scale |
| 3 | Make Peace with Food | Food Guilt and Satisfaction, Mindful Eating | Reflect on Experiences with Food Guilt; Mindful Eating |
| 4 | Body Appreciation | Self-Perception, Body Image Pressures | Operation Beautiful; Make Positive Post-Its |
| 5 | Appreciating You | Fat Talk/Body Talk, Self-Reflection | What is seen on the outside vs what we value on inside |
| 6 | Feeding Your True Hunger | Non-Hunger Eating, Recognizing and Coping with Emotional Eating | Develop an Emotional Self-Care plan |
| 7 | Movement for Fun | Exercise, Why we exercise, Yoga | Activity Self-Quiz; Reflect on Negative Self-Talk |
| 8 | Gentle Nutrition | Principles, Balancing Enjoyment and Nutrition, Food Labels | Make a Recipe Card for Success |

## Appendix B

IES-2 Final Model Syntax

```
*null model

MIXED IES_Total WITH Timepoints0
/Fixed =
/Method = ML
/Print = G solution testcov
/Repeated = Timepoints0 | SUBJECT(Index) COVTYPE(UN).

MIXED IES_Total WITH Timepoints0 Group_T1
/FIXED = Timepoints0 Group_T1
/Method = ML
/Print = G solution testcov
/Repeated = Timepoint | SUBJECT(Index) COVTYPE(UN).

MIXED IES_Total WITH Timepoints0 Group_T1
/FIXED = Timepoints0 Group_T1 Timepoints0*Group_T1
/Method = ML
/Print = G solution testcov
/Random = Intercept Timepoints0 | SUBJECT(Index) COVTYPE(UN).

*adding BMI as a covariate

MIXED IES_Total WITH Timepoints0 Group_T1 BMI
/FIXED = Timepoints0 Group_T1  BMI Timepoints0*Group_T1
/Method = ML
/Print = G solution testcov
/Random = Intercept Timepoints0 | SUBJECT(Index) COVTYPE(UN).

*dummy coding time

MIXED IES_Total WITH t1 t2 BMI Group_T1
  /FIXED= Group_T1 t1 t2 BMI t1*Group_T1 t2*Group_T1 | SSTYPE(3)
  /METHOD=ML
  /PRINT=G  SOLUTION TESTCOV
/REPEATED = TimePoint | SUBJECT(index) COVTYPE(UN).

* T1 vs T2 & T3

MIXED IES_Total WITH t2 t3 BMI Group_T1
  /FIXED= Group_T1 t2 t3 BMI t2*Group_T1 t3*Group_T1 | SSTYPE(3)
  /METHOD=ML
  /PRINT=G  SOLUTION TESTCOV
```

```
/REPEATED = TimePoint | SUBJECT(index) COVTYPE(UN).

MIXED IES_Total WITH t2 t3 BMI Group_T1
  /FIXED= Group_T1 t2 t3 BMI | SSTYPE(3)
  /METHOD=ML
  /PRINT=G  SOLUTION TESTCOV
/REPEATED = TimePoint | SUBJECT(index) COVTYPE(UN).
```